1 Fields And General Relativity

In this chapter there is a discussion of how one defines a field in Pi-Space. The accepted field theory for Gravity is General Relativity is this is covered as well to explain the Gravity Field. I will also include Feynman's QED, QM and the work of Dirac.

1.1 Defining The Field Notation

In order to first deal with fields in Pi-Space we need a new Field notation similar to the wave notation. Simply put, a field is a three dimensional wave field, made up of and containing Pi-Shells which operate on different wave layers. The Field Geometry I will initially deal with at the Local Layer is Pi-Shell based and therefore Spherical (Electric and Gravity field). The field is represented by an extension of the Nx(y) notation.

For the Field we have a "FielD" FDx(y) notation related to the parent wave x and its wave layers y. Presently, these can be either Electric or Gravity based. Later I will add Turbulence and Magnetic. But for now, this leads to

FDe(y) - Electric wave based field

FDg(y) – Gravity wave based field

The respective "y" components map to the previously defined wave layers from the Nx(y). Please read the *Advanced Quantum Theory* and *Temperature And Super Conductivity* sections if you are unsure. These layer definitions still apply to the Fields

The Electric Field

Field FDe(y)	*Name*	*Size (Decreasing)*	*Related Wave*
FDe(0)	Electric Field	>= Planck Length	Ne(0)
FDe(1)	Charge Field	<Planck Length	Ne(1)

So we have a three dimensional Electric Field. This field carries smaller three dimensional charge field entries. More detail on this later. We can go deeper but we do not for now. Both the Electric Field and the Charge Field entries can be defined by Pi-Shells. The Electric Field is composed of Local waves > Planck Length and the Pi-Shell is therefore measurable in the Local Frame. The Charge Field is a Pi-Shell whose size is less than the Planck Length.

This field is generated by related Ne(x) electric charges, typically located at the center of FDe(x) field.

I will provide a diagram later.

Next we take a look at the Gravity field.

Field FDg(y)	*Name*	*Size (Decreasing)*	*Related Wave*
FDg(0)	Gravity Field	>= Planck Length	Ng(0)
FDg(1)	Mass Field	<Planck Length	Ng(1)

So we have a three dimensional Gravity Field. This field carries smaller three dimensional mass field entries. More detail on this later. We can go deeper but we do not for now. Both the Gravity Field and the Mass Field entries can be defined by Pi-Shells. The Gravity Field is composed of Local waves > Planck Length and the Pi-Shell is therefore measurable in the Local Frame. The Mass Field is a Pi-Shell whose size is less than the Planck Length.

So, how does this elementary definition of a Gravity field relate to our current understanding of Gravity in Newtonian and Einstein GR sense?

Field FDg(y)	*Name*	*Theory*
FDg(0)	Gravity Field	Newtonian Gravity Field, Gauss Gravity Field, Einstein General Relativity Metric Solution
FDg(1)	Mass Field	Einstein General Relativity Curvature Quantum Field Theory

The Newtonian Gravity Field primarily deals with the Local Spherical Solution for Gravity which mainly deals with the planet as a Pi-Shell at the FDg(0) layer. There is no attempt to model how this field is formed. In Pi-Space, this is seen as a Theory using Local waves. Gauss also uses a Spherical Solution.

Einstein's General Relativity deals with the field as a Curvature of Space and Time due to mass. In Pi-Space, this is seen as modeling Curvature at the FDg(1) Layer. Solutions to the Einstein Field Equations using the Schwarzschild Metric model a Spherical FDg(0) Pi-Shell with Local Polar (or not) Co-ordinates.

Quantum Field Theory models the Mass Field.

For the Electric Field, we have Gauss and Maxwell.

Wave FDe(y)	*Name*	*Theory*
FDe(0)	Electric Field	Gauss Electric Field, Maxwell Electric Field
FDe(1)	Charge Field	

These mainly deal with Local field quantities and some Spherical solutions. Please understand this notation before proceeding.

1.2 Wave And Particle Duality in the Field

What type of behavior does the Field support? In the Pi-Space definition of a field, waves and particles move through the fields. However, the field itself gives rise to virtual particles and supports our concept of three-dimensionality. Therefore, in each point in a Pi-Space field, the field supports both a wave and a particle. Therefore, the Quantum Mechanical interpretation of wave-particle duality is supported at each layer in a Pi-Space field.

Let's take for example a Gravity field which we know is three dimensional as modeled by the Schwarzchild Metric.

In our case, the local Gravity field is at the FDg(0) layer.

Beneath that is the mass FDg(1) layer. These waves/particles are smaller than the Planck Length. Therefore, these mass field waves can support tiny Pi-Shells which make up the three-dimensional nature of the field.

Field FDg(y)	*Name*	*Size (Decreasing)*	*Pi-Shell*
FDg(0)	Gravity Field	>= Planck Length	Planet Gravity Field
FDg(1)	Mass Field	<Planck Length	Tiny Pi-Shells

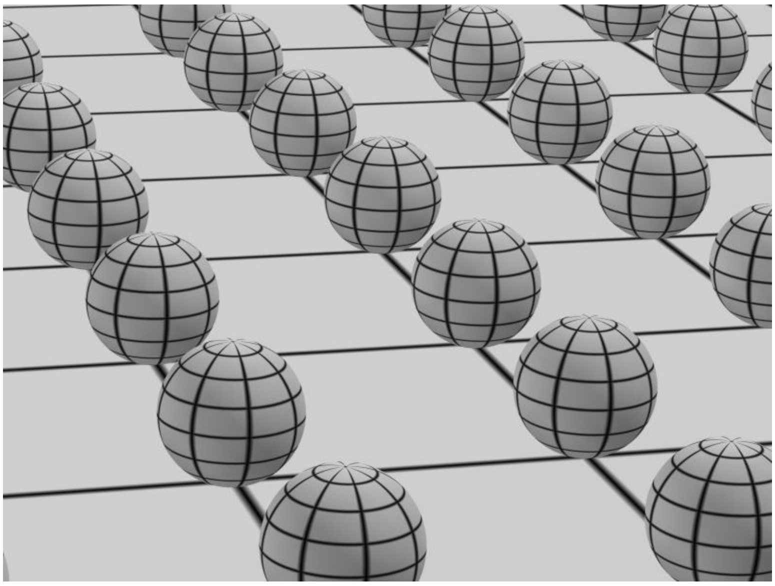
How can we visualize this?

First, we consider the planet. This has already been discussed in the *Understanding Gravity* section in the Pi-Space documentation. Please read this before proceeding if you are unsure.

We can model the Earth as a single field which is a Local Pi-Shell.

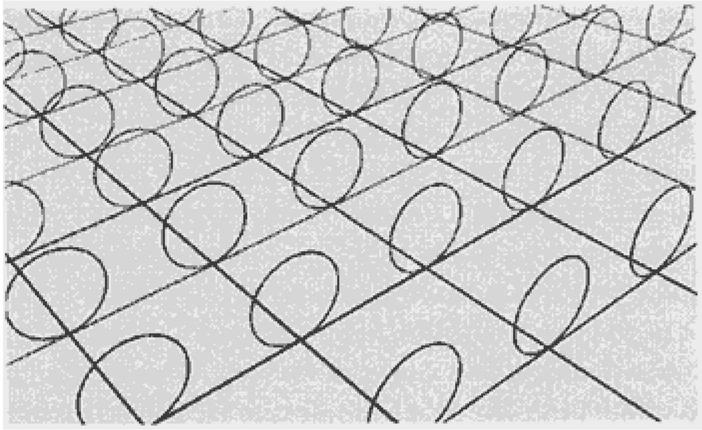
Therefore, relative to us, this Pi-Shell is our FDg(0) Pi-Shell.

Now, if we go down to FDg(1), it looks like this. Each tiny point in the Mass field which makes up the FDg(0) can itself support Non-Local Pi-Shells.



This is a FDg(1) field view. Note: This is borrowed from the Kaluza-Klein work. I will explain Kaluza-Klein and why it works once I cover Einstein's General Relativity and Electro-Magnetic fields.

One can also imagine the FDg(1) field layer supporting waves, so we can visualize something like this. Note: This diagram is sourced from String Theory.



In terms of a Planet, we can imagine the local wavelength shortening as one towards a Planet sized Pi-Shell field.

Note: The amendment to these diagrams which I will explain is the changing diameters of these Pi-Shells (both large and small) and how this ultimately map to the Einstein concept of Curvature.

1.3 Gravity Field And Particle Mass Interaction

Individual particles contain mass waves at the Ng(1) layer.

These reside in the Ng(0) layer which is a local wave greater than the Planck Length.

Ng(0) = Local wave (>= Planck Length)

Ng(1) = Mass (<Planck Length)

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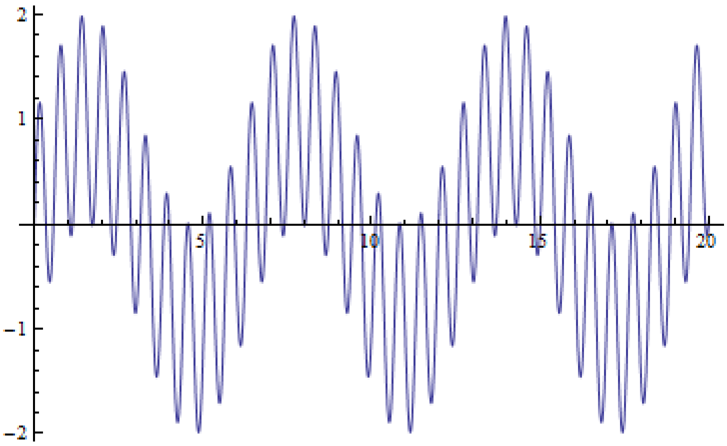
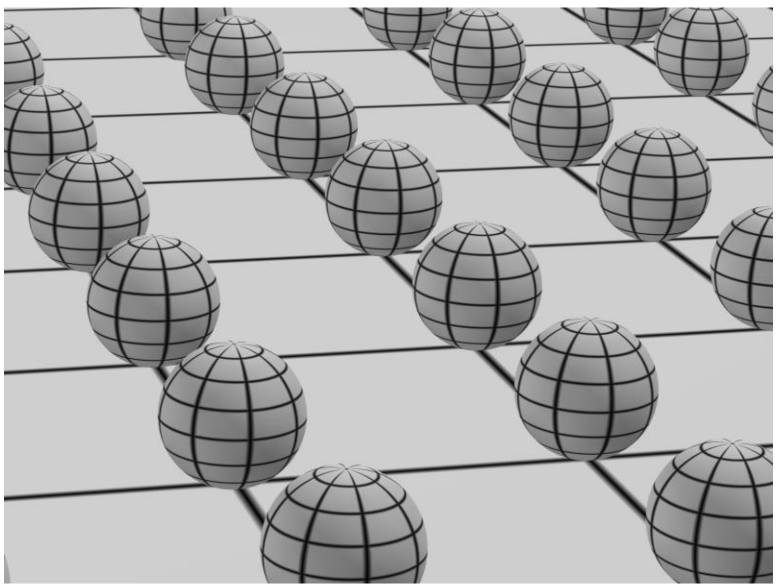


These mass waves alter the Gravity field points at the FDg(0) layer. The Gravity field points can be represented by either a particle or a wave whose size is greater than the Planck Length. Combined, these points form a planet.

Individually, the planet is composed of wave/particle points, similar to the mass field but these Pi-Shells are greater than the Planck Length.



The degree of interaction of the Ng(1) mass waves to the Gravity field is covered by the Universal Gravitational constant.

Therefore, the total Gravity field is handled by the sum of the planet's mass Ng(1) waves.

The Newtonian Gravity field is the local field FDg(0) and covers sum of planet's mass.

$$FDg(0)\, planetGravityField = G * \sum Ng(1)$$

However, we need to think in terms of Units. In Pi-Space, force is related to an area change on a Pi-Shell as it escapes from a planet due to the mass of that planet. We think of the planet as a Pi-Shell and the total area loss of the Pi-Shell related to the Ng(1) mass is related to the planet's radius. This is the Gravitational Potential, or total area change for a particle moving from the edge of the field to the center of Gravity.

$$FDg(0)\, planetFiel\, dPotential = -\frac{G * \sum Ng(1)}{r}$$

This is analogous to the Newtonian formula

$$Fpotential = -\frac{GM}{r}$$

To calculate the area loss in relation to distance for a Pi-Shell moving in the Gravity field, we divide by r once again to figure out area loss of Pi-Shell due to distance.

$$Fg = -\frac{GM}{r^2}$$

Therefore FDg(0) Gravity field alters the Geometry of the Ng(0) particle, making it smaller as it moves towards the center of Gravity. Therefore as one moves in towards the center of the Gravity one gets smaller by g/c^2*h.

Note that FDg(0)potential is the sum of all the FDg(0) Gravity field points. These are represented by both a wave and a particle. These wavelengths are greater than the Planck Length.

$$FDg(0)planet = \sum FDg(0)fieldPo\text{ int }s$$

Therefore we can state that a Gravity field's curvature is the product of the Gravity field points as they become smaller/closer together in the direction of the center of Gravity and are greater than the Planck Length.

$$\sum FDg(0)planetGravityFieldPo\text{ int }s = G * \sum Ng(1)planetMassParticles$$

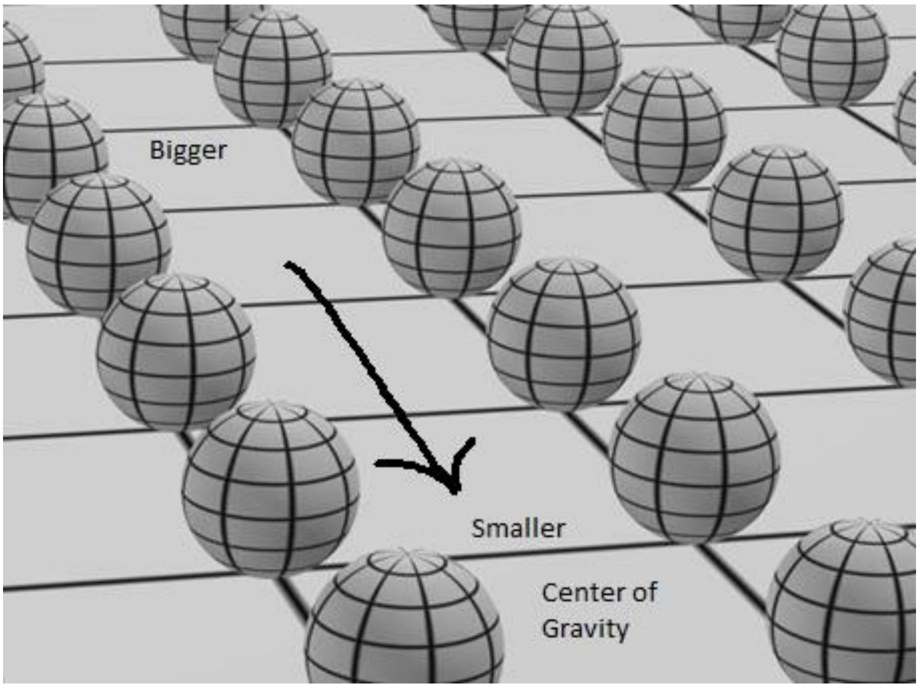
What this means is that the shrinkage of a Pi-Shell as it moves into a Gravity field is the product of the Gravity Field points it moves through. The Gravity Field itself is formed by the Sum of all of the Mass of the Planet's mass Ng(1) times the Universal Gravitational.

We can divide by r to get the potential and r^2 to get the area change with respect to distance which is what Newton did.

So now, we have a situation where the mass of the Planet affects the size of the Gravity Field points. Please understand this principle before moving forward.

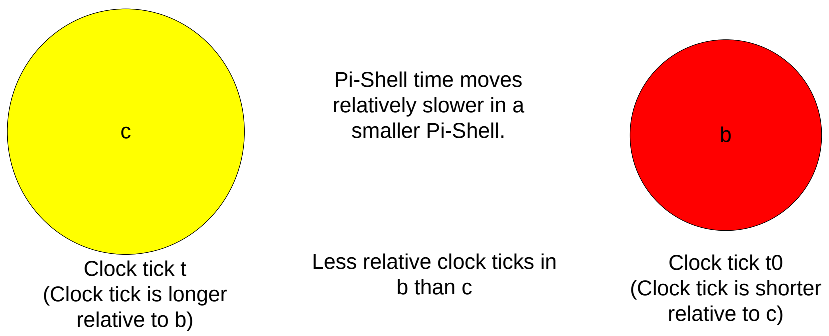
In a weak Gravity field, the change is just g/c^2 area change to an Atom per distance h, for the Gravity field moving in the direction of the center of Gravity.

Here we draw the Local Field FDg(0) whose points are greater than the Planck Length (unlike the Mass Field) but whose size is getting smaller in the direction of the center of Gravity.



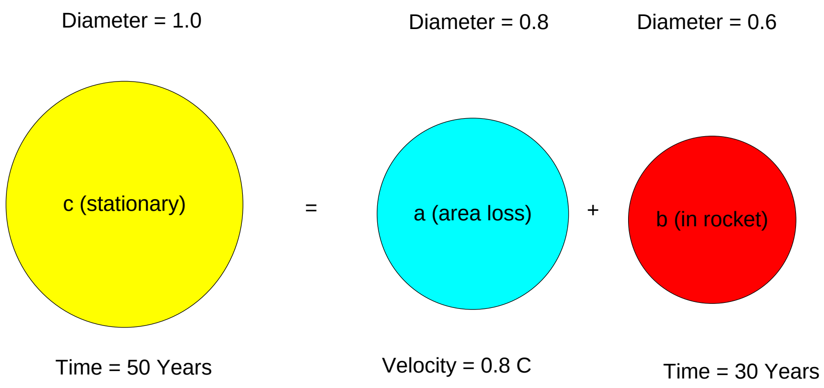
1.4 The Four Vector And Time

Foundational to General Relativity is that time is a dimension. Here I will explain how this concept maps to a Pi-Space Field. The nature of velocity based time t has already been covered in Pi-Space in the Introduction to the Theory. Please read this to understand the nature of the Lorentz-Fitzgerald transformation which is an adaption of the Pythagorean Theorem. Time is a property of a Pi-Shell and is related to the Area change of a Pi-Shell due to velocity based movement. Ultimately the time component is proportional to the diameter change where area change is proportional to the diameter squared. If you are unsure of this, please read the Introduction to the Theory. Therefore dilating time does contribute to the curvature of Space Time which Einstein showed. In Pi-Space, as a Pi-Shell moves faster due to velocity it becomes smaller and loses area relative to an observer. The way we visualize this in Pi-Space is in the following way.



$$t = \frac{t_0}{\sqrt{1 - \frac{v^2}{c^2}}}$$

Each Pi-Shell has its own clock tick length. Applying the example of an astronaut traveling at velocity 0.8c for 30 years, we get 50 years for the stationary observer. The Lorenz Transformation for 0.8c yields a Pi-Shell b moving diameter of 0.6.



The ratio of Pi-Shell b diameter to Pi-Shell c diameter is 1/0.6 = 1.66667

$$\begin{aligned} &Diameter\,\alpha\,Time \\ &0.6 = 30 Years \\ &Therefore \\ &1.0 = 50 Years \end{aligned}$$

Now we can do this the other way around where we want to measure with respect to the Observer.

$$t * \sqrt{1 - \frac{v^2}{c^2}} = t_0$$

In General Relativity, we can represent this relationship in a co-ordinate time way. This is GR "Proper Time" way. We measure relative to the Observer, which is Pi-Shell c above.

$$\Delta\tau = \sqrt{\Delta T^2 - (v_x \Delta T/c)^2 - (v_y \Delta T/c)^2 - (v_z \Delta T/c)^2} = \Delta T \sqrt{1 - v^2/c^2},$$

We do this for the different axes along a path.

$$\tau = \int_p \sqrt{dt^2 - \frac{dx^2}{c^2} - \frac{dy^2}{c^2} - \frac{dz^2}{c^2}}$$

So I can remain at (0,0,0) for 50 years and not move. Therefore the answer for Proper Time is 50 years.

$$\sqrt{50^2} = 50$$

This is analogous to a Pi-Shell remaining stationary.

Alternatively, we can say that the astronaut has traveled 0.8 C for 50 years. The time component is relative to the stationary observer, so we want the proper time that the Astronaut experiences.

50*0.8 = 40 light years distance travelled.

$$\sqrt{50^2 - 40^2}$$

$$\sqrt{2500 - 1600}$$

$$\sqrt{900}$$

30 light years proper time

Alternatively, we can use the Pi-Shell idea of Time being a Diameter change to a moving Pi-Shell. First, we calculate the Area Change and then we square root it to get back to the diameter and then multiply this by the Observer Time.

$$t * \sqrt{1 - \frac{v^2}{c^2}}$$

$$50\sqrt{1 - \left(0.8^2\right)}$$

$$50\sqrt{1 - 0.64}$$

$$50\sqrt{0.36}$$

$$50 * 0.6$$

30 light years proper time

This is the mapping of Pi-Shell "a" to Pi-Shell "c".

So one might ask, what is the benefit of using the second Pi-Shell approach? The answer is that using this approach, the mindset is to "calculate the area changes to the Pi-Shell". It does not just have to be velocity. I can be anything which affects area. Then simply square root it to get the diameter and multiply this by the Observer time and you get the Proper Time.

Also recall in Pi-Space that, we have a smarter way to calculate this using Trig

$$\sqrt{1-\frac{v^2}{c^2}} = Cos(ArcSin(v/c))$$

This simplifies to

$$t * Cos(ArcSin(v/c))$$

$$50 * Cos(ArcSin(0.8))$$

30 light years proper time

One can validly ask, why bother with this approach? If one reads the Advanced Formulas section, one can see how straight forward it is to jump from diameter to area and back. Classically this maps to velocity and energy. In Classical Physics we deal with Non Linear Partial Differential Equations which require solving when one attempt to add other effects such as pressure, shear, temperature and so on. Therefore, this is a useful approach.

Let's get back to the Time as a fourth dimension.

Next, Minkowski noticed the four dimensional relationship and declared therefore that time could be seen as a fourth dimension within a matrix notation which Einstein accepted. I will not go into Minkowski here in great detail. I covered the diagrams somewhat in the introduction. This gives us a 4x4 matrix with a signature as follows.

$$\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & -1 & 0 & 0 \\ 0 & 0 & -1 & 0 \\ 0 & 0 & 0 & -1 \end{bmatrix}$$

Units are

$$\begin{bmatrix} t\text{^}2 & 0 & 0 & 0 \\ 0 & -\dfrac{1}{c\text{^}2} & 0 & 0 \\ 0 & 0 & -\dfrac{1}{c\text{^}2} & 0 \\ 0 & 0 & 0 & -\dfrac{1}{c\text{^}2} \end{bmatrix}$$

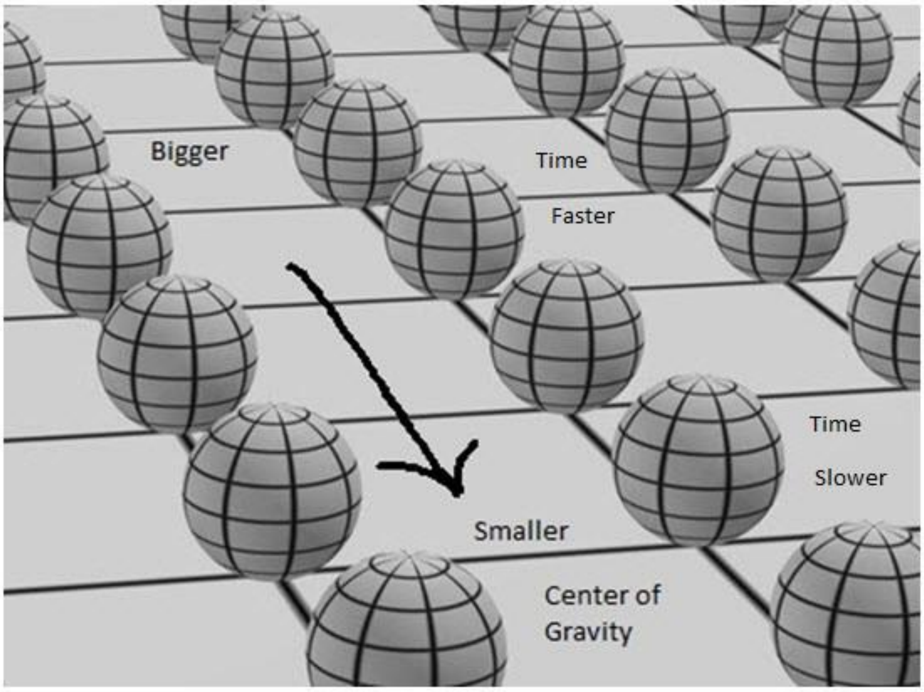
If we think purely in Pi-Space terms, the squaring of time means that we are dealing with a squared diameter change which maps to an area change on the Pi-Shell. Also c^2 is also an area calculation. Therefore this expression is an area change expression on a Pi-Shell due to a path moved within a field relative to an observer at co-ordinates (0,0,0).

Using the GR notation, proper time looks like using a defined Metric. I will cover this in more detail later.

$$d\tau = \sqrt{dx_\mu \ dx^\mu} = \sqrt{g_{\mu\nu} \ dx^\mu \ dx^\nu}.$$

Note: We use a Sqrt here because time is proportional to the diameter change. Therefore if we have an area calculation, we just sqrt it to get back to the diameter change.

Now, the next important point to make is that we are not dealing with a moving Pi-Shell in Pi-Space, we are dealing with the area change due to the Field. Therefore, if we map this idea to the Pi-Space Field, this is the signature for a Pi-Space “Space Time Point” which we model as a Pi-Shell Field point. Therefore, if we imagine that time is a 4th Dimension we can model this as Pi-Space Field shell points getting smaller as they move towards the Center of Gravity. They contain both distance and time encoded in relative area/diameter change in this case in the direction of the center of Gravity. In Pi-Space, the clock tick of time is related to the changing size the moving Pi-Shell as it moves through a field of Pi-Space points which warp the moving Pi-Shell. So the moving Pi-Shell gets smaller and faster (aka gains Kinetic Energy) and its clock tick slows (GR field effect) as well.



The smaller Pi-Shells have a Smaller Clock tick. As a moving Pi-Shell passes through this warped Space it shrinks and it can be viewed as a Fourth Dimension in GR Matrix notation. In Pi-Space, this just maps to a shortening in the diameter of a Pi-Shell/atom moving through this warped space. If instead we have a wave moving through these Pi-Space field points, they shorten in the direction of the center of gravity.

One of the more fun parts of the Proper Time is that we can also apply it to a more complex metric such as the Schwarzchild metric. Here the area change is a little more complex as we are dealing with Polar Co-ordinates. The idea here is to explain Heuristically how to understand how the formulas work.

This is based on a Wikipedia example

The Schwarzchild radius is

$$d\tau = \sqrt{\left(1 - \frac{2m}{r}\right) dt^2 - \frac{1}{c^2}\left(1 - \frac{2m}{r}\right)^{-1} dr^2 - \frac{r^2}{c^2} d\phi^2 - \frac{r^2}{c^2}\sin^2(\phi)\, d\theta^2},$$

where

t is time as calibrated with a clock distant from and at inertial rest with respect to the Earth,

r is a radial coordinate (which is effectively the distance from the Earth's center),

ϕ is a co-latitudinal coordinate, the angular separation from the north pole in radians.

ϑ is a longitudinal coordinate, analogous to the longitude on the Earth's surface but independent of the Earth's rotation. This is also given in radians.

m is the geometrized mass of the Earth, $m = GM/c^2$,

M is the mass of the Earth,

G is the gravitational constant.

The Schwarzchild radius is

$$r_s = \sqrt{\frac{2GM}{c^2}}$$

When (standing on North pole)

$$dr = d\theta = d\phi = 0$$

Proper time is

$$d\tau = \sqrt{1 - \frac{2GM}{rc^2}}$$

We get

$$d\tau = \sqrt{\left(1 - 13908x10^{-9}\right)dt^2} = \left(1 - 6.9960x10^{-10}dt\right)$$

In Pi-Space, we get

$$d\tau = Sin\left(ArcCos\left(1 - \frac{2GM}{rc^2}\right)\right)$$

Now if we add the rotation of the Earth, we get

$$d\tau = \sqrt{\left(1 - 13908x10^{-9}\right) - 2.4069x10^{-12}dt^2} = \left(1 - 6.9660x10^{-10}dt\right)$$

One more in Pi-Space, we get

Proper Time

$$d\tau = Sin\left(ArcCos\left(1 - \frac{2GM}{rc^2} - (rotationOfEarth) \right) \right)$$

$$d\tau = Sin(ArcCos(1 - (areaChangeOnNorthPole) - (areaChangeRotationOfEarth)))$$

Therefore we start with an observer Pi-Shell (area sized 1, units c^2) and subtract the area changes and convert it into a diameter change for Proper Time.

This is the heuristic way to understand these equations in Pi-Space.

Please take a look at the Advanced Formulas for how I solved Navier-Stokes. The velocity equation looked like this, where I calculated each area change.

Navier Stokes Solving For Velocity (See Quantum Theory Doc/Advanced Section)

For xy, yz and zx axis e.g.

$$FlowVelocity_{xy} = Sin\left(ArcCos\left(1 - \frac{\left(\frac{p}{\mu\rho}\right)}{c^2} - \frac{\frac{gh}{\mu}}{c^2} - \frac{\frac{k}{\mu}(\nabla T)}{c^2} - \frac{ExtTurb}{c^2} \right) \right) * c$$

Please notice that we are also subtracting things like pressure and Gravity etc; for the moving particle/Pi-Shell. The only real difference to this formula is that we multiply it by the value ‘C’ to get a Newtonian velocity.

Therefore we can conclude in Pi-Space that Proper Time is a "pure" diameter change calculation in Pi-Space; namely we don't need to multiply by constant 'C' speed of light.

Note: Pi-Space does not take a position on whether Time is a Fourth Dimension or not. However, Mathematically in Pi-Space, Proper Time is related to a Pi-Shell Diameter Change as I've shown.

1.5 The Metric

The Metric and Proper Time are closely related. In Pi-Space, we have the Square Rule.

The area of a sphere is

$$4\pi r^2$$

where r is the radius. The first logic jump into Pi-Space is to define the area of a Pi-Shell in terms of its diameter and not its radius. Therefore, the area of a Pi-Shell is

$$\pi d^2 = area$$

where d is the diameter. *This is called The Square Rule in Pi-Space and is one of the foundational formulas of Pi-Space.* The surface of a Pi-Shell is composed of Waves which have distinct wavelengths. When the wavelengths are changed either by a field such as Gravity or an External force, the diameter of the Pi-Shell is altered.

We can map the change in Area of a Pi-Shell to the Metric.

Also we can map the change in diameter of a Pi-Shell / atom to Proper Time, as has been shown already.

Therefore the relationship between Proper Time and Area is as follows.

$$\pi\tau^2 = ds^2$$

Where

τ = Proper Time

And

ds^2 is the Metric

In Pi-Space, this is the reason why Proper Time and the Metric have this squared relationship. The Constant Pi is ignores as it is a constant in current Physics according to the Pi-Space Theory.

Next, when one covers the effect of a Gravity field in Pi-Space, one deals with the area change due to that Gravity field. This is typically called the Potential in Newtonian Gravity. I've covered this already in the advanced sections and we can set the Kinetic Energy equal to the Potential Energy.

$$\frac{gh}{c^2} = 1 - Cos\left(ArcSin\left(\frac{v}{c}\right)\right)$$

On the left hand side we have the Potential. On the right we have the Kinetic Component. General Relativity does not actively use the idea of Kinetic Energy instead preferring to use curvature and the geodesic.

However it does need to have some mechanism to represent the total area change due to a Gravity field.

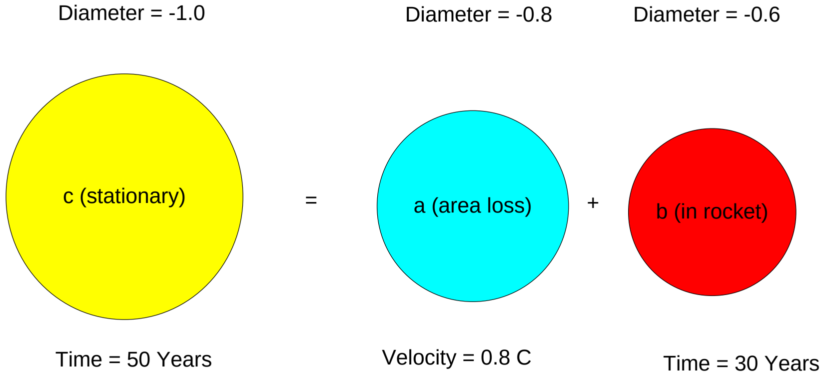
In the simplest case, we have Flat Space which has a Minkowski Metric representing area change due to a field.

The preferred signature for GR I've seen is -+++

$$\begin{bmatrix} -1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

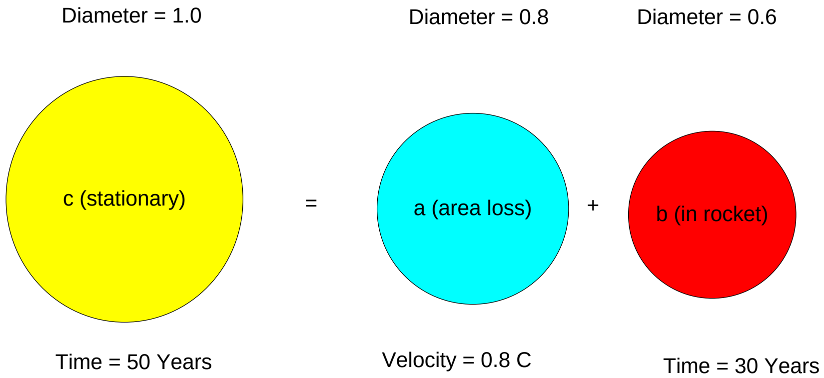
In this case, we model the Observer Pi-Shell as having area -1 and then add the co-ordinate movement with respect with the Observer time.

We then think in terms of "negative area" due to this notation.



Pi-Space prefers the signature +--- where we have a Pi-Shell with are 1. Therefore we think of a Pi-Shell getting smaller due to velocity or a field and "positive area".

$$\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & -1 & 0 & 0 \\ 0 & 0 & -1 & 0 \\ 0 & 0 & 0 & -1 \end{bmatrix}$$



Note the way that the diameter is 1.0 instead of -1.0

However, GR chose -+++ so we have the idea of a stationary Observer having -1 area. Then we add the co-ordinate movement and we can then move towards 0 or a positive value for the metric.

This is how we calculate area change, thinking in terms of Pi-Space. We define the Line Element as the Invariant Interval squared.

$$ds^2 = g_{\mu\nu} dx^\mu dx^\nu .$$

Using the Light Cone idea using this negative area signature (where we have an Observer with area -1), we end up with the following cases.

The line element ds^2imparts information about the causal structure of the spacetime.

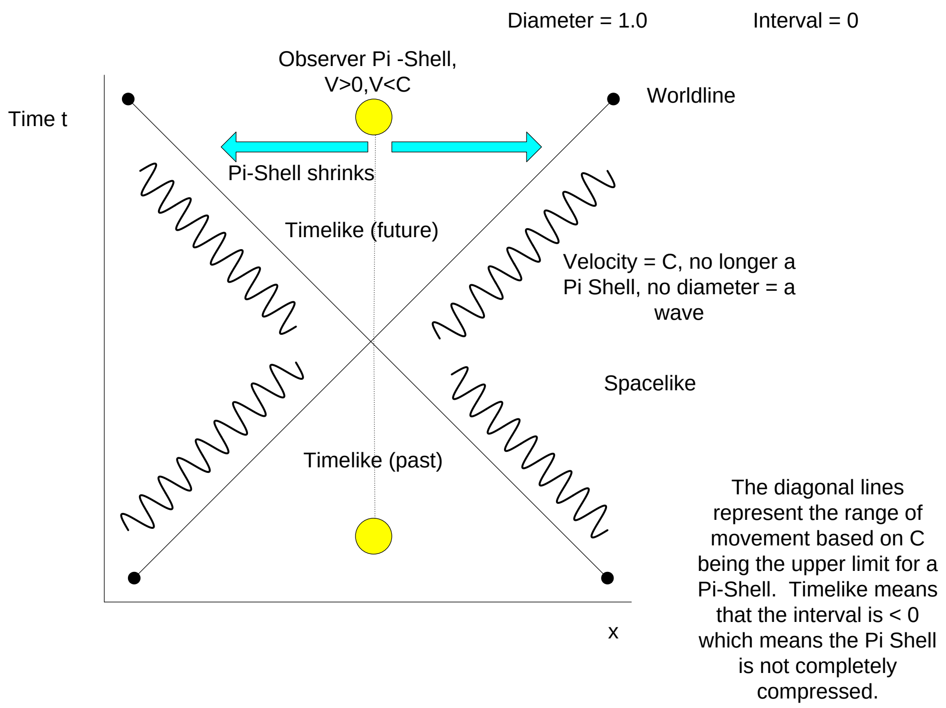
When $ds^2 < 0$, the interval is timelike and the square root of the absolute value of ds^2 is an incremental proper time. Only timelike intervals can be physically traversed by a massive object. *The Pi-Shell "b" is smaller than the Observer Pi-Shell "c" and is not traveling at the speed of light.*

When $ds^2 = 0$, the interval is lightlike, and can only be traversed by light. *The Observer Pi-Shell "c" is completely compressed. It is a wave.*

When $ds^2 > 0$, the interval is spacelike and the square root of ds^2 acts as an incremental proper length. Spacelike intervals cannot be traversed, since they connect events that are out of each other's light cones. Events can be causally related only if they are within each other's light cones. *The wave is completely compressed. In this case, we are dealing with the Advanced Quantum wave within wave format. The can be seen as a Non Local space. Ds^2 <=0 means it is Local.*

For the Flat Metric

$$ds^2 = dx^2 + dy^2 + dz^2 - (ct)^2$$



In a timelike interval, we have proper time. As I've shown already, we are dealing with the diameter change due to the Observer Pi-Shell losing area. We have to square root the absolute area value in order to get the Proper Time.

For the Schwarzchild Metric, a simple case for P-Space is

$$d\tau = Sin\left(ArcCos\left(1 - \frac{2GM}{rc^2} \right) \right)$$

However, we do not need to Square Root it. We are dealing with pure area change for the Metric.

Besides the flat space metric the most important metric in general relativity is the Schwarzschild metric which can be given in one set of local coordinates by

$$ds^2 = -\left(1 - \frac{2GM}{r}\right) c^2 dt^2 + \left(1 - \frac{2GM}{r}\right)^{-1} dr^2 + r^2 d\Omega^2$$

where, again, $d\Omega^2$ is the standard metric on the 2-sphere. Here G is the gravitation constant and M is a constant with the dimensions of mass.

Therefore, this is a Pure Area Pi-Shell Change expressed in General Relativity.

$$ds^2 = Metric = AreaChange \approx GPE$$

Where

GPE = Gravitational Potential Energy

We can convert the Metric to the Pi-Space version PE=KE. Field Area Change produces Pi-Shell area change which causes acceleration.

$$-\frac{2GM}{rc^2} = 1 - Cos\left(ArcSin\left(\frac{v}{c}\right)\right)$$

Solving for v/c; Note 2GM/r is divided by c^2 as it is area. We take a simple case where one is just standing on the North Pole.

$$\frac{v}{c} = Sin\left(ArcCos\left(1 - \frac{2GM}{rc^2}\right)\right)$$

Adjusting to Pi-Space units of area

$$v = Sin\left(ArcCos\left(1 - \left(\frac{2GM}{rc^2}\right)\right)\right) * c$$

Therefore we can place the GR Metric into Pi-Space formulas as they are Area Changes. For example, this is the Escape Velocity for this Metric (velocity due to area change).

Note: From the Schwarzchild derivation, 2GM/rc^2 is due to a weak field approximation with Newtonian approximation. In "pure" Pi-Space, we use GM/rc^2 which matches the Weak Field as well. See Advanced Formulas for more info.

Therefore, heuristically in Pi-Space the one thinks of the GR Metric as a way compute the various area change[s] to a Pi-Shell based on a co-ordinate system containing physical properties.

The Proper Time is a Square Root of this to find the Diameter Change. So when we square the Proper Time (aka Diameter) we get the Metric value (Area Change).

We can also add the area changes due to Electric Charge and a Spinning object. Recall in Pi-Space that Electric Change also causes an area change on a Pi-Shell. The Kerr-Newman metric for example computes this.

Heuristically like Proper Time, we can state the following in Pi-Space

For Proper Time

$$d\tau = Sin\left(ArcCos\left(1-\left(areaChangeOnNorthPole\right)-\left(areaChangeRotationOfEarth\right)\right)\right)$$

For an Area Based Metric, using the Pi-Space concepts, we can equate this to Kinetic Energy.

Note: Kinetic Energy is seen as a loss in area relative to an observer

$$areaChangeOnNorthPole + areaChangeRotationOfEarth = KineticEnergy$$

$$areaChangeOnNorthPole + areaChangeRotationOfEarth = 1 - Cos\left(ArcSin\left(\frac{v}{c}\right)\right)$$

It’s important to understand that an area gain due to a field effect while moving up and out of a Gravity field which is seen as a Gravitational Potential, for example has a corresponding area loss while moving down in it for a particle which is called Kinetic Energy.

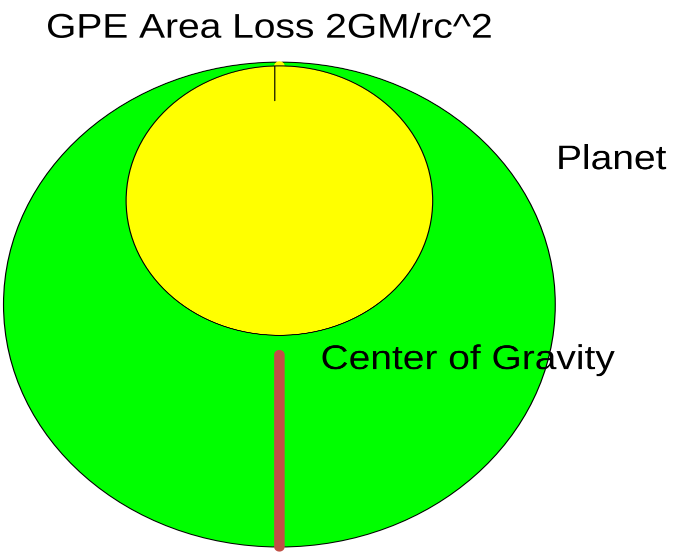
So

Gravitational Potential – Kinetic Energy = 0

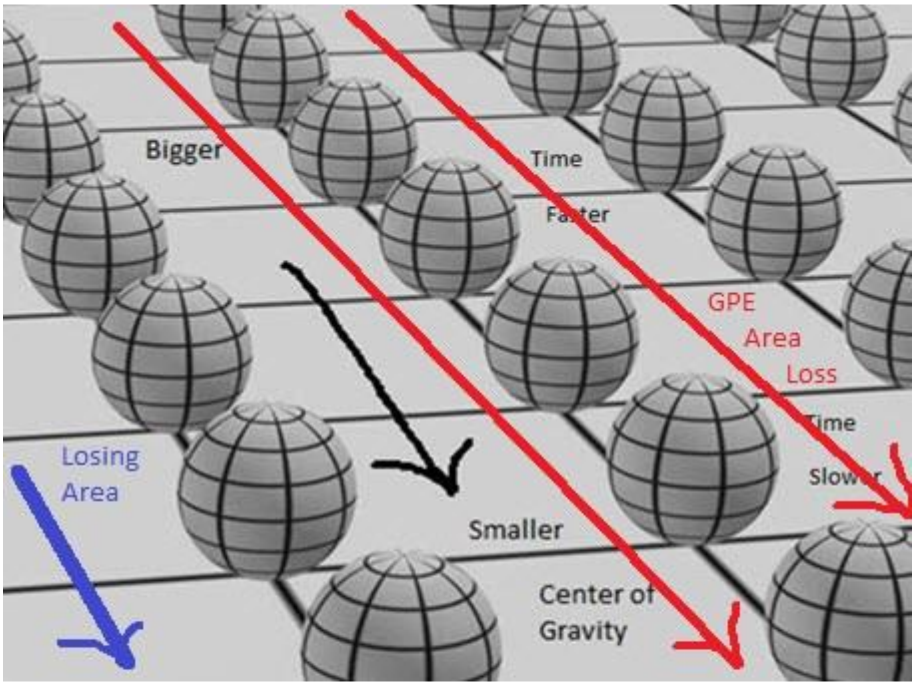
Seen in Pi-Space as Area Change

Upward Field Energy Area Gain – Downward Particle Energy Area Loss = 0

Visually we can think of the Gravitational Potential Energy as the change in area of a Pi-Shell stretching from the COG to the edge of the field. This is the Pi-Shell / Atom view within the field. Note, the Diameter Line of the GPE Area Loss Pi-Shell represents the Escape Velocity. This is the total area loss of a Pi-Shell / atom as it moves from the COG to the edge of the Gravity field.



At the quantum level, the FDg(x) viewpoint is that the field points get smaller as one moves towards the COG. The sum of these field point area changes produces the Metric / Gravitational Potential.

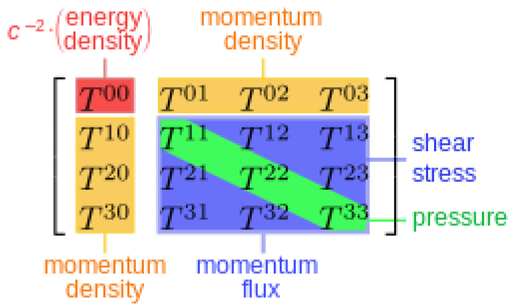


Of course in a more sophisticated Metric we can have spin and charge. However, the general point to make is that all of these co-ordinate calculations are seen as calculating field point area changes relative to an external observer who wants to know properties such as Proper Time and the Line Element.

1.6 Stress Energy Tensor in Pi-Space

We have already covered the area change due to the Gravitational Potential. In Pi-Space and General Relativity we deal with more than this. We cover other forces which change the area of one or more Pi-Shells. These include Pressure, Shear, Temperature and so on.

Einstein formulated the Stress Energy Tensor.



These are all energy calculations so they are area changes due to a Pi-Shell.

We use units where 1 = c^2.

This has already been covered in Pi-Space under the Advanced Formulas piece. It is covered under the Navier-Stokes piece.

Navier-Stokes covers both the Energy version and the Velocity version due to these effects. These are very difficult to solve using differential calculus however in Pi-Space it's reasonably straight-forward.

If we solve General Relativity for velocity using Pi-Space we get

For xy,yz and zx axis e.g.

$$FlowVelocity_{xy} = Sin\left(ArcCos\left(1 - \frac{\left(\frac{p}{\mu\rho}\right)}{c^2} - \frac{\frac{gh}{\mu}}{c^2} - \frac{\frac{k}{\mu}(\nabla T)}{c^2} - \frac{ExtTurb}{c^2} \right)\right) * c$$

However we want the Energy component which is

$$Energy = 1 - \frac{\left(\frac{p}{\mu\rho}\right)}{c^2} - \frac{\frac{gh}{\mu}}{c^2} - \frac{\frac{k}{\mu}(\nabla T)}{c^2} - \frac{ExtTurb}{c^2}$$

Clean up the speed of light

$$EnergyChange = 1 - \frac{p}{\mu\rho c^2} - \frac{gh}{\mu c^2} - \frac{k}{\mu c^2}(\nabla T) - \frac{ExtTurb}{c^2}$$

This includes gravity, pressure, viscosity, temperature, external turbulence.

In the case of the Stress Energy Tensor, all we need to do is drop the Gravity piece.

$$StressEnergyChange = 1 - \frac{p}{\mu\rho c^2} - \frac{k}{\mu c^2}(\nabla T) - \frac{ExtTurb}{c^2}$$

The value 1 is the Momentum Energy and is a standard Observer value.

Note: To get Newtonian Energy, multiply the result by c^2.

1.7 Orbits for General Relativity and Pi Space

I have already shown in the Orbits section that one can calculate an Orbit using the Law of the Sines and the Law of the Cosines. See Orbits Chapter for more information. What is telling about this piece is that the next calculated position uses Newton’s distance formula.

However, in order to be compatible with General Relativity and factoring in the small perturbations to Space and Time, we must replace the Newtonian piece with the Pi-Space formula for distance s.

The distance an object travels while accelerating is defined by Newton as

$$distance = v_0 t + \frac{1}{2} a t^2$$

We're interested in the second part of the formula, which is the acceleration part

$$accelerationDistance = \frac{1}{2}at^2$$

This is the summing up of the Kinetic Energy component over time t and averaging it which produces the general version of the formula. Time t is multiplied by acceleration a, to produce a velocity v and halved to get the average velocity. The average velocity is then multiplied by time t once more to get the distance traveled.

Here we use the Pi-Space average velocity.

$$distance = v_0 t + \left(\frac{1 - Cos\left(ArcSin\left(\frac{at}{c} \alpha\langle v_0, v_0 + at\rangle \right)\right)}{ArcSin\left(\frac{at}{c} \alpha\langle v_0, v_0 + at\rangle \right)} \right) t$$

Where

$$\frac{at}{c} \alpha\langle v_0, v_0 + at\rangle \leq 1$$

Note: α is applied to the acceleration range vel *start* to vel *end* e.g. 0.1 to 0.2C

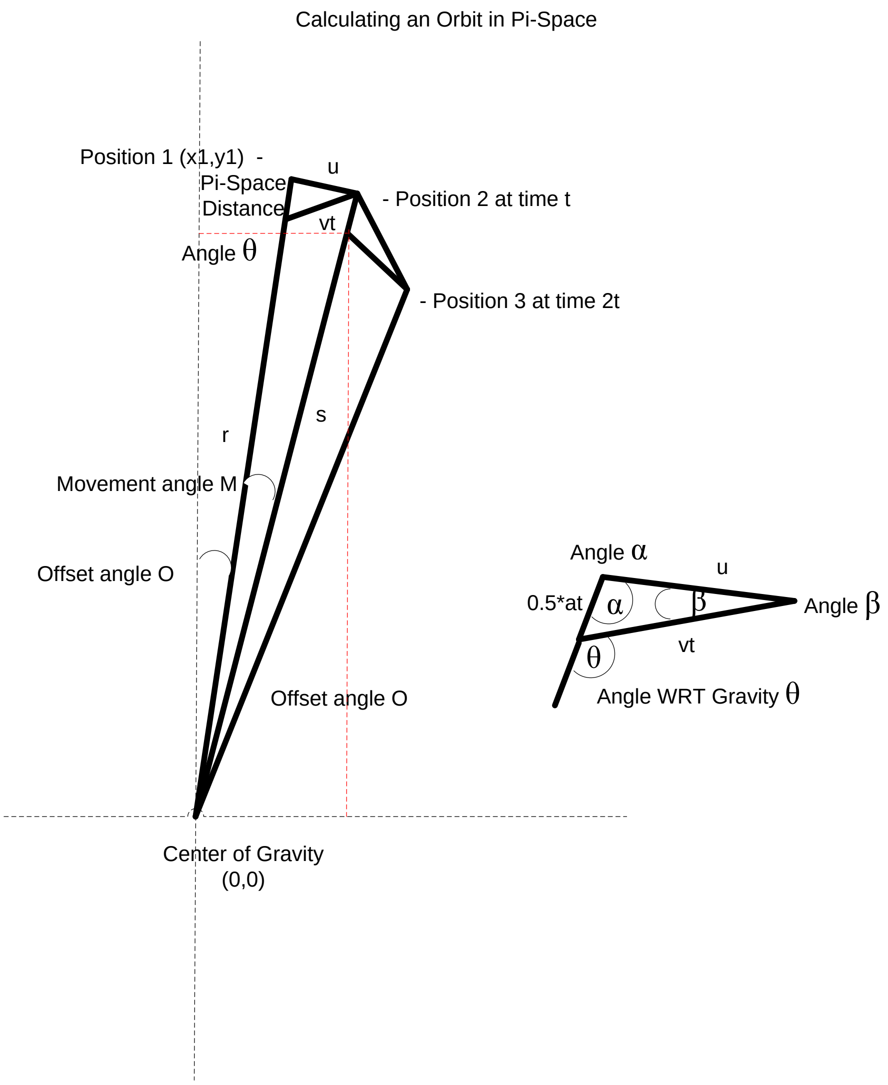
Details on this can be found in the Advanced Formulas Section.

Note: There is no straight-forward way to solve for time t using this approach but it is more accurate while calculating distance.

```
Table[((1-Cos[ArcSin[0.01*t]])/(ArcSin[0.01*t]))*t,{t,1,10,1}]
```

{0.00500004,0.0200007,0.0450034,0.0800107,0.125026,0.180054,0.2451,0.320171,0.405274,0.500418}

Let's revisit the diagram and update it to use the Pi-Space Formula. The important piece to note here is that this will give an answer which is almost the same as the Newtonian piece and factor in adjustments.



The high level steps are.

1. Choose x1,y1 moving with velocity v under an acceleration a and angle θ to that Gravity field, center of gravity distance r, offset angle O wrt to axes

2. Calculate a from Newton a = GM/r^2 (M is mass of object)
3. Calculate the Interior Angle (180 – θ) of orbit triangle
4. Calculate Pi-Space distance

$$distance = v_0 t + \left(\frac{1 - Cos\left(ArcSin\left(\frac{at}{c} \alpha\langle v_0, v_0 + at \rangle \right)\right)}{ArcSin\left(\frac{at}{c} \alpha\langle v_0, v_0 + at \rangle \right)} \right) t$$

Where

$$\frac{at}{c} \alpha\langle v_0, v_0 + at \rangle \leq 1$$

5. From distance and Interior Angle, calculate u (Law of Cosines)
6. From u,Interior Angle, distance, calculate β (Law of Sines)
7. Calculate α from 180 – β - InteriorAngle
8. Calculate S from t,u, α (Law of Cosines)
9. Calculate M from s, α,u (Law of Sines)
10. Calculate New Offset Angle = 0 + M
11. Goto step 1, d(new) = s, θ(new) = θ – β, v(new) = u, offset angle O is O+M
12. (new)x1 = s * Cos(90-New Offset Angle), (new)y1 = s * Sin(90-New Offset Angle)

1.8 The Geodesic for General Relativity and Pi Space

The definition of a Geodesic is: Of, relating to, or denoting the shortest possible line between two points on a sphere or other curved surface.

Therefore it's the shortest path in curved Space. In Pi-Space, this refers to the path that either a wave or a particle prefers to travel in.

Therefore in Pi-Space, the General Rule of Thumb relating to the Geodesic is:

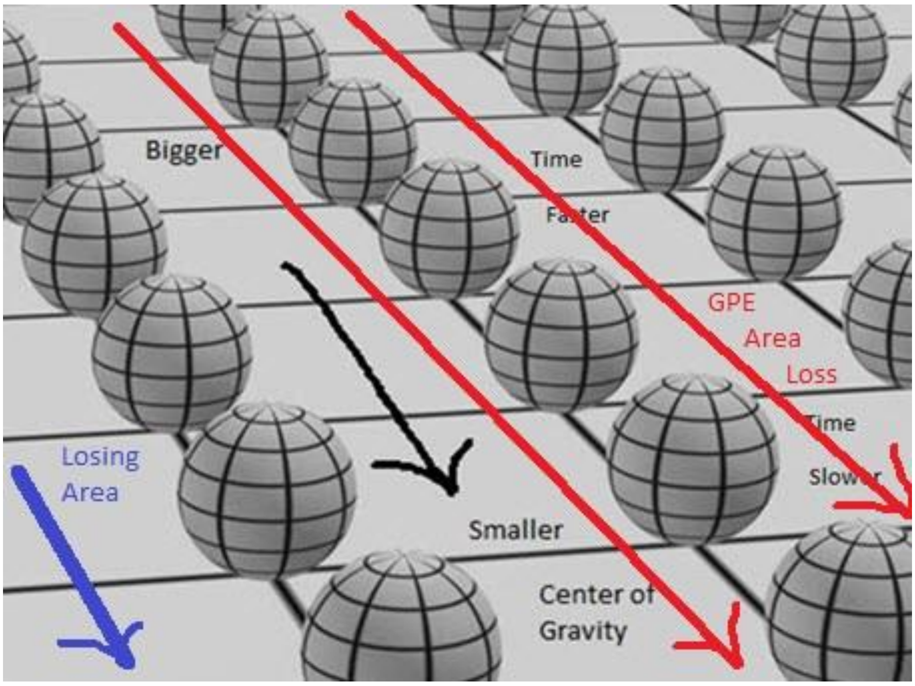
The path that a wave or a particle prefers to travel in Space Time is the one where its wavelength is shortest or the particle's diameter is the smallest.

Note: If all field points are the same size then the wave/particle will continue in the same direction which is the traditional "straight line" on a traditional flat surface/flat space time. This is the simplest case and the one we are most familiar with but the general rule is that the wave/particle is looking for the path where its wavelength/diameter is the shortest.

This definition includes curved space or flat space, or even a body which is spinning and electrically charged, or any other combination of forces which cause a wave or a particle to become smaller.

It turns out that the Geodesic is the shortest path because along this path, the wave or particle will be the smallest.

Take for example a particle freely falling to Earth with no initial velocity. It will always follow the path straight down because the field points are the smallest in this direction.



What follows from this is the principle of Least Time which I will describe next.

1.9 The Principle of Least Time in Pi-Space

In optics, Fermat's principle or the principle of least time is the principle that the path taken between two points by a ray of light is the path that can be traversed in the least time.

Here we deal with the next refinement of the Field Point idea for Space Time. Now we are talking about how either waves or particles choose to move through Space Time. For particles, we can refer to the Geodesic.

Recall

The path that a wave or a particle prefers to travel in Space Time is the one where its wavelength is shortest or the particle's diameter is the smallest.

Also please recall that when either a wave or a particle moves through Space Time field points, the wave length is altered by the size of the Field Points.

So, if the field points become smaller, then the Wavelength shortens as it moves through it.

Conversely, if the field points become larger, then the wavelength lengthens.

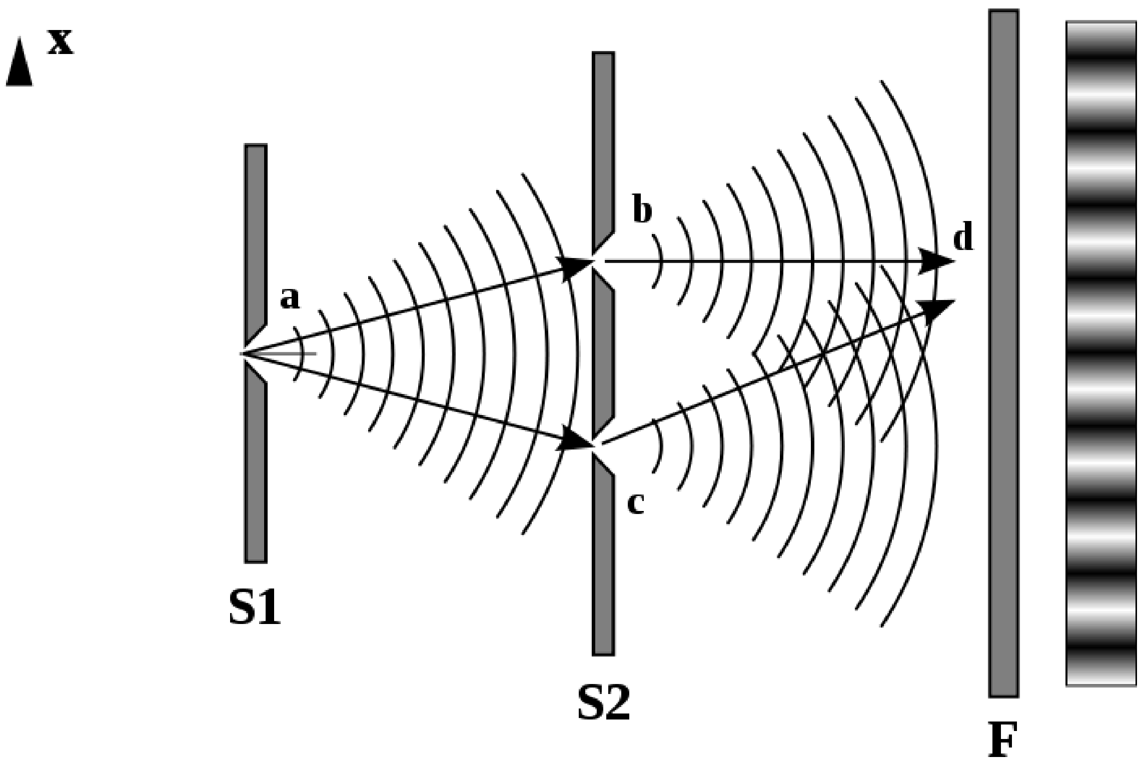
A shorter wavelength moves faster, therefore the path that a ray of light moves in or a freely falling particle will move in is a direction where the solution is the least time.

1.10 Wave And Particle in Pi-Space

One of the most famous experiments in physics is that of light behaving like both a wave and a particle. In Pi-Space, this is reasonably straight forward to explain.

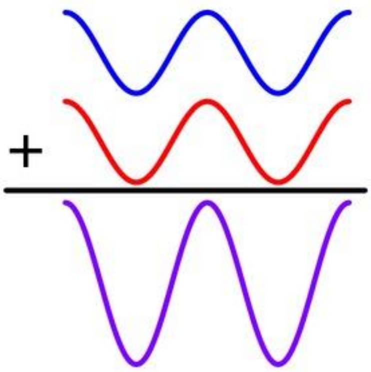
The Wave

When a particle of light moves through Space Time in Pi-Space it produces ripples in the Space Time Field Points. In simple terms, some Field Points become larger and others become smaller. Traditionally, the wave effect is drawn as Probability ripples which can combine or cancel one another out.



The place where the waves combine is the place where the particle is most likely to appear when running the experiment. The Rule of Thumb in Pi-Space is very simple. **The place where the Probability Waves combine to produce the highest probability is the place where the Field Points are the smallest.**

This is all one needs to know. High probability means a relatively Smaller Field Point. By how much one might ask? The key point to note here is that we cannot measure beyond smaller than the Planck length so therefore we are forced to use Probability. However, the point to make is that the Field Points do physically change in size at this layer.



This is constructive interference. Here the Space Time field points are the smallest.

Also please note that because the Space Time field points are smaller than the Planck Length, when this field effect happens **it happens in advance of the movement of the particle whose size is greater than or equal than the Planck Length.**

So from a timing viewpoint, the Field Points provide a path for the particle in advance of its movement.

Next - The Particle

The rule of thumb for a particle is pretty straight forward. The particle moves along a Field Point path where the Field Points are the smallest. This is how it "sniffs" its way thought Space Time. **This is the same as the Path of Least Time.** If it is an Electron or a Light Wave (see what these look like in the Advanced Quantum Doc) they will both follow this path. Any local wave will follow the Path of Least Time through Space Time Field Points.

So why does it not follow the same path every time? The answer is that the Field Points sizes are constantly changing due to the movement of the particle through the Field Points which are changing in size with time. Therefore, certain paths will contain the smallest field points

and therefore these locations have the highest probability of the particle arriving that this point on the detector surface.

1.11 Adding Detector to Wave And Particle Experiment in Pi-Space

Once a detector is added to an experiment positioned over the slits, one finds that the particle only goes through this slit. Why is this? The answer in Pi-Space is that the Field Point space time particles are the smallest at this point. The reason why they are the smallest at this place is because the detector needs to “observe” the area. To do this, it needs to fire particles over this location. The act of firing the particles over this location causes the field points to be the smallest at this point. Therefore the non-observing particle chose to go through the slot which is being observed.

1.12 Calculating Probabilities in Pi-Space

Probabilities are added up and squared to calculate the total probability of the particle appearing at the detector.

$$\psi(\vec{x},t) = e^{i(\vec{k}\cdot\vec{x}-\omega t)} = e^{i(\vec{p}\cdot\vec{x}-Et)/\hbar}$$

$$P(\vec{x},t) = |\psi(\vec{x},t)|^2$$

$$P_{\text{detector}} = |\psi_1 + \psi_2|^2$$

Converting this into Pi-Space, the exponent models the probability wave in the layer where the waves are smaller than the Planck length. Therefore we use probabilities. The higher the probability the smaller the Field Point. We then apply time t and figure out what size the Field Point is at this moment. The final step is to add up the probabilities. Why do we need to square them? Firstly, the probability wave function is based on the diameter size of the Pi-Shell, **not the area.** Therefore in order to find the smallest Field Point we need to square the probability to determine the area change.

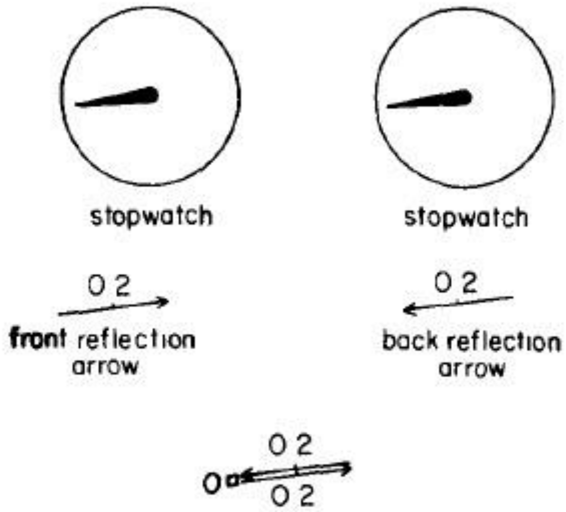
This is why Pdetector works. Here we model the area change of the Field Points based on the wave function diameter change.

Note: We map the wave amplitude to the diameter change of the Field Point. Squaring gives us the Field Point area change.

1.13 QED in Pi-Space

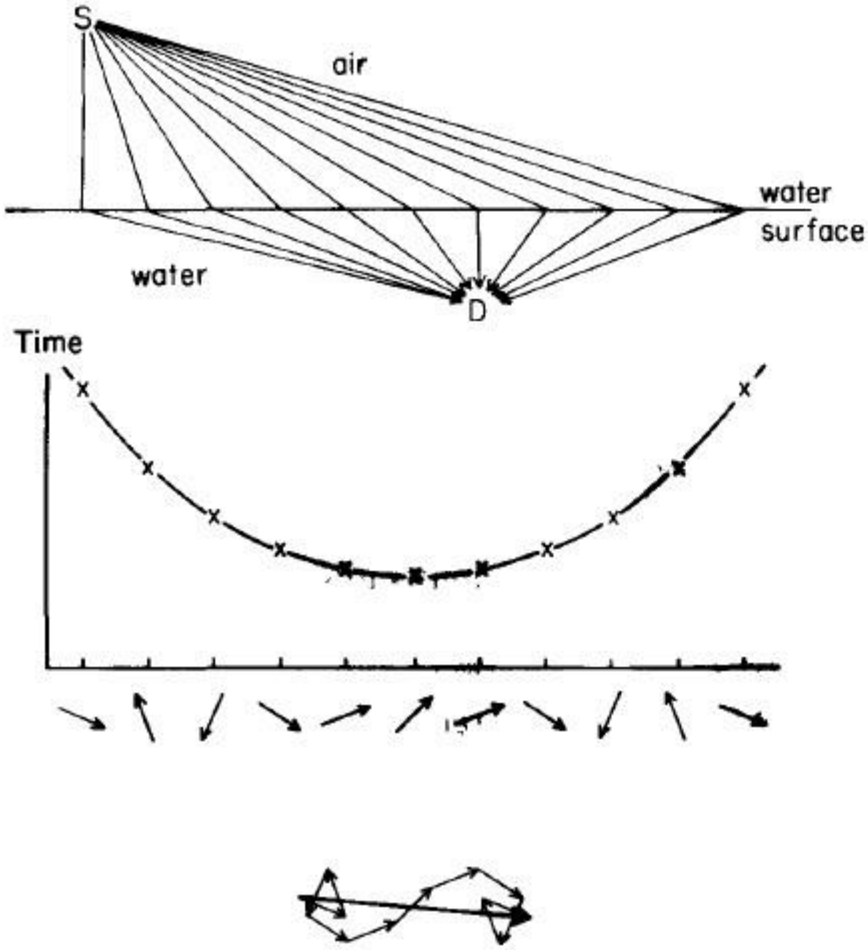
Richard Feynman developed an “arrow notation” to reflect how one could draw Quantum Electro Dynamic interactions. One of these is how light reflects and finds the shortest path. He had no concept of Field Points and some being larger or smaller than others. He did have Probability Amplitudes and practical experiments. From this, he developed the rules of “Arrow Addition”. He imagined that the probability amplitudes were spinning at a certain rate. He then modeled how the arrows were represented to show the location where light followed the Path of Least Time.

First, there is the stop watch idea with arrow amplitude.



You add each arrow “head to tail” to calculate the total probability. In this case, it cancels as it is a reflection.

Next we see a more developed idea of a refractive surface. This is taken from Richard P. Feynman’s QED book.



In the diagram taken from the book, we see that the path of Least Time is the place where the probability addition arrows combine to form a larger total probability. It naturally works out that this is the place where the path of Least Time is.

How does this map to Pi-Space Field points?

The Rule of Thumb in Pi-Space is: **The location where the combined head to tail arrows are the largest is the place with the highest probability where the Pi-Space field points are the smallest. This is also the place where the path of Least Time is.**

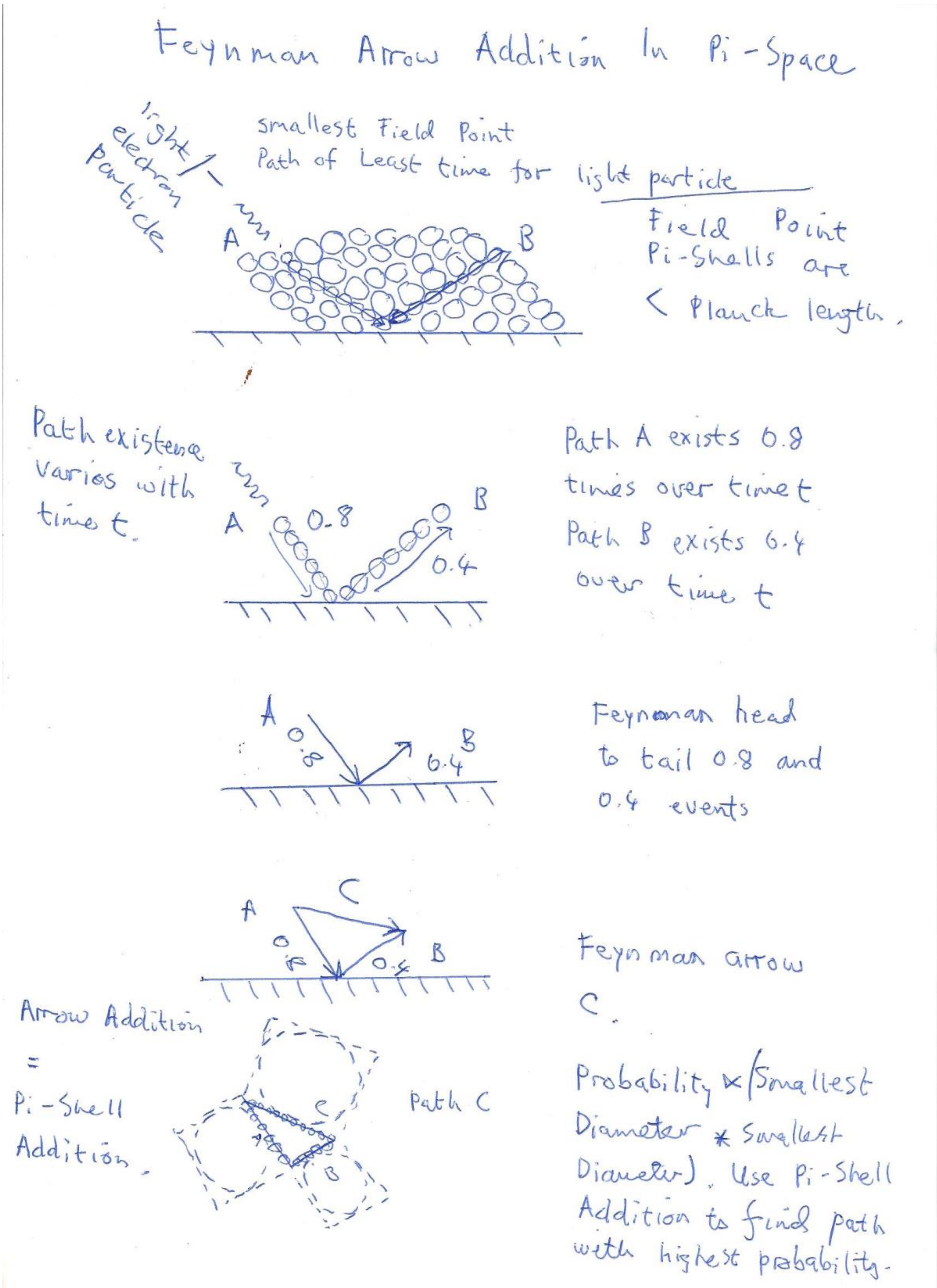
Note that the field points change with time t. They are not always the smallest. This is the reason why a certain percentage of results, for example might pass through a piece of glass while most of the time they do not and reflect. The field points are changing size with time t (a bit like waves on an ocean, some area are more choppy than others).

1.14 Feynman Arrow Addition in Pi-Space

Feynman arrow addition in Pi-Space. Basically, the path of least time is the path the particle takes which has a probability of existing over time t. Draw an arrow representing each path and add them together. The probability is proportional to the smallest diameters squared to get the overall area change. The greater the arrow length, the smaller the Pi-Shells on the path is over time t. Adding the arrows is Pi-Shell addition. We square the arrow lengths.

Note: In the diagram below, the path with probability of 0.8 should have smaller Pi-Shells on this path A versus path B with probability of 0.4. So the probability is related to the diameter shrinkage. We square it to get the area which is Pi-Space addition. See Introduction to Pi-Space.

Therefore arrow length is proportional to relative diameter loss. The smaller Field point Pi-Shells are the path most travelled over time t and which increases their probability.



1.15 Glass Reflection in Pi-Space

Here we explain how glass reflection works.

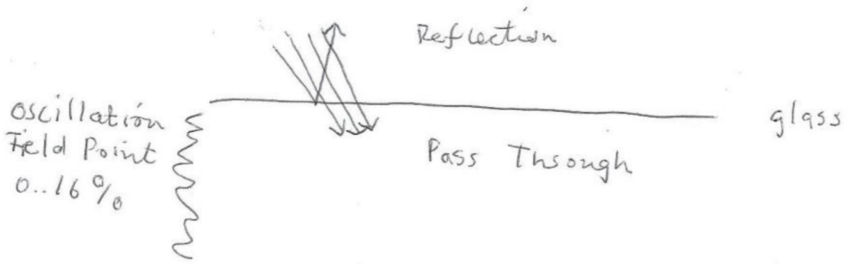
Explaining Glass Reflecktion In Pi-Space

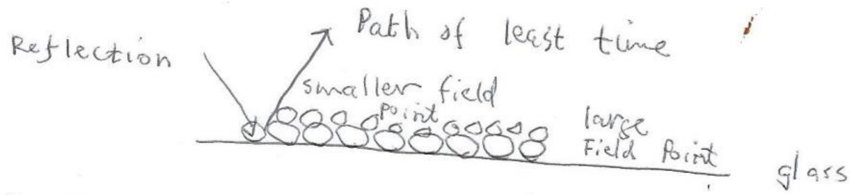
Field Point has oscillation of its area
0.. 16%

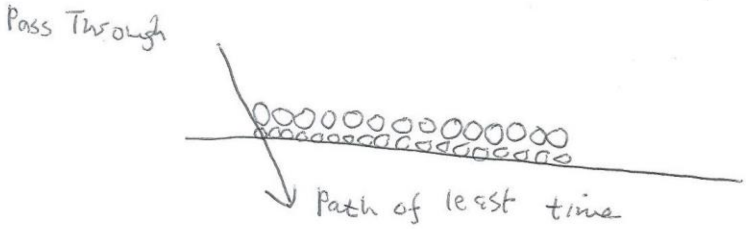
16% oscillation. 0% oscillation

Field Point Pi-Shell < Planck Length.

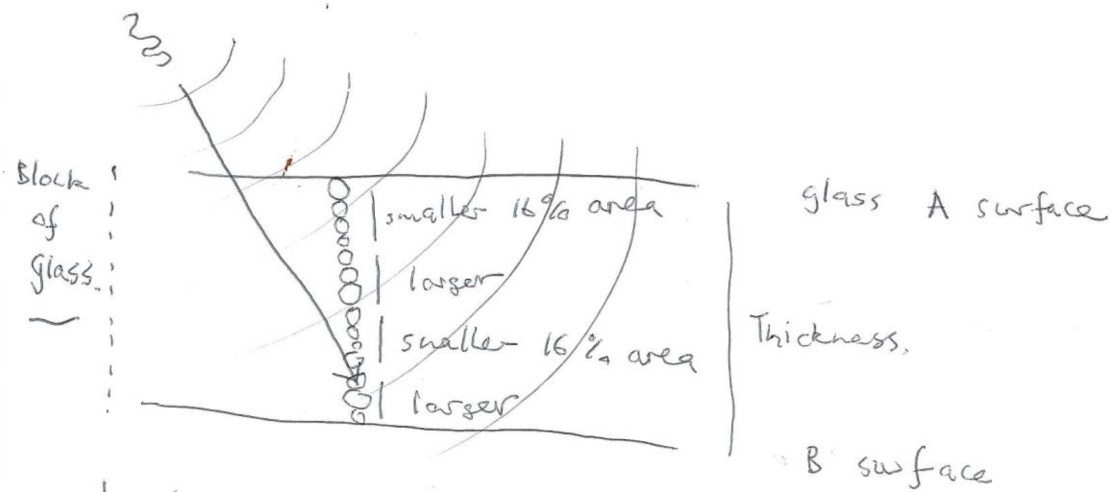
Oscillation caused by presence of glass.
Oscillation goes in cycles in presence of glass.







Thickness of glass. Field Points oscillate in Glass. The particle generates waves that cause the field points to oscillate,



In some cases path of least time is pass through

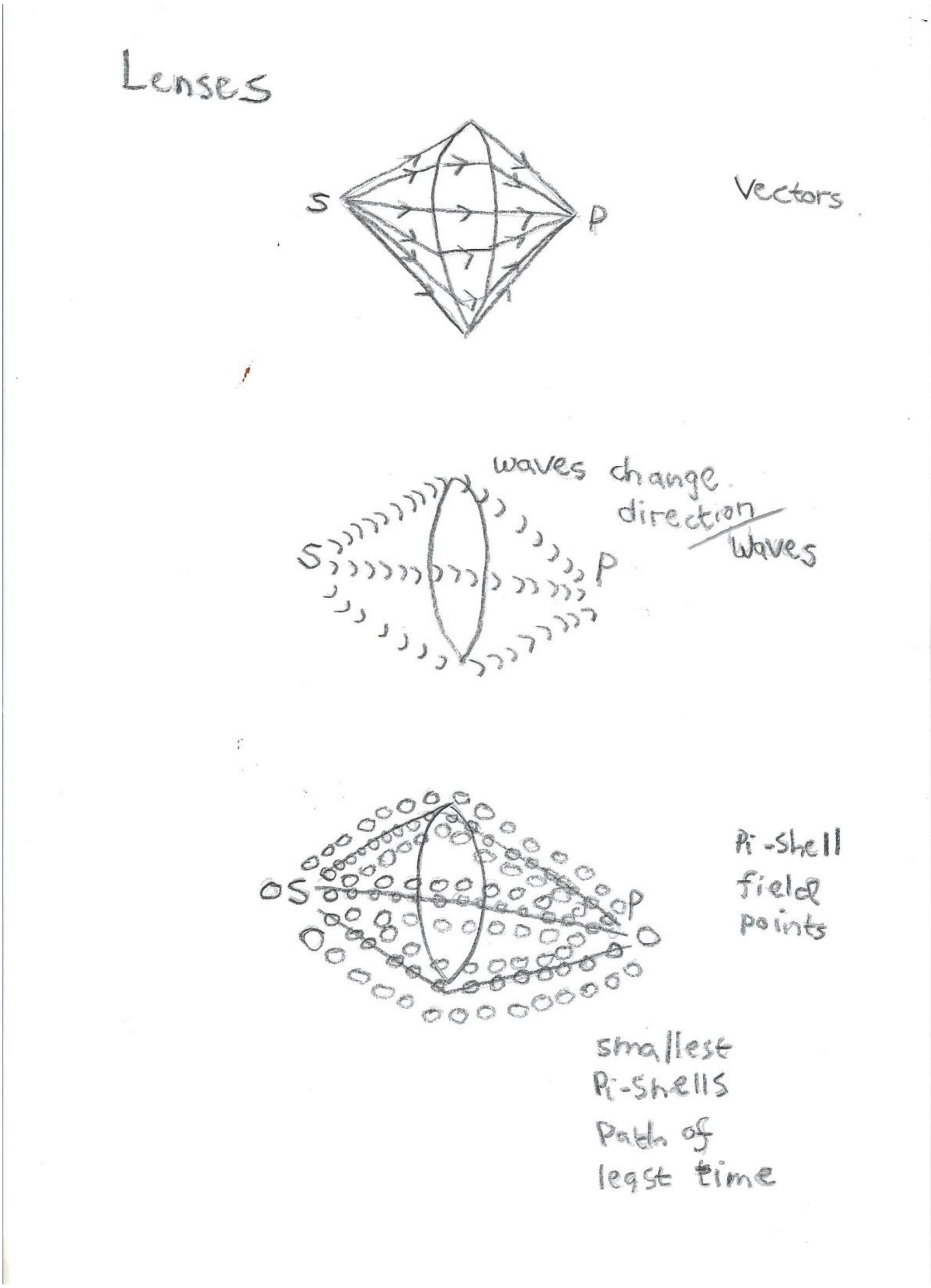
In other cases path of least time is reflection,

When the Field points are getting smaller, the light passes through.

When the Field points are getting larger, the light reflects.

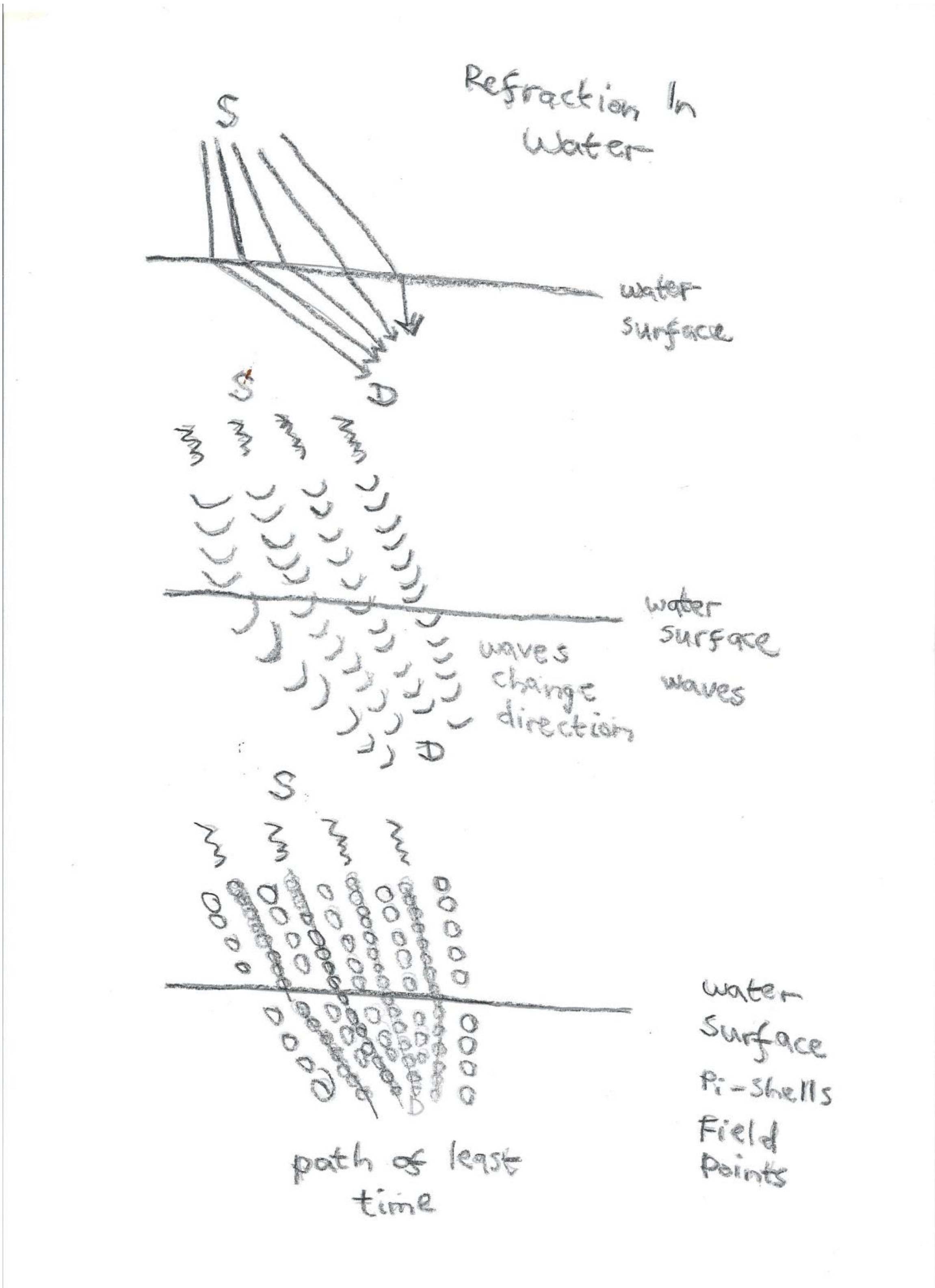
1.16 Lenses in Pi-Space

Here's how lenses works.



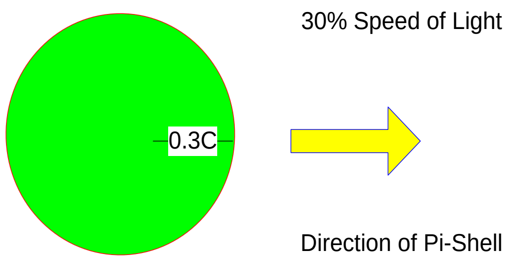
1.17 Refraction in Pi-Space

Here’s how refraction works.



1.18 Local Pi-Shell Versus The Probability Pi-Shell

The traditional Pi-Shell is based on local waves which are no smaller than the Planck Length and can be measured within our realm in terms of velocity and acceleration. A Pi-Shell such as this has a maximum speed of light.

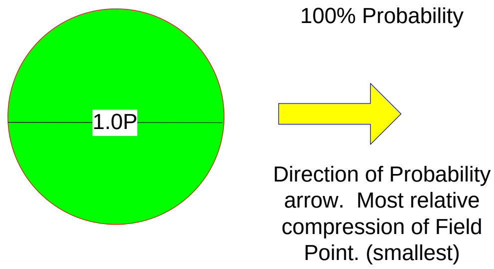


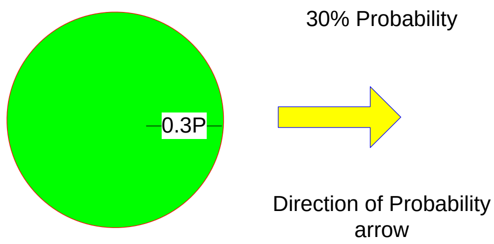
A non-local Pi-Shell existing in a place smaller than the Planck length cannot be measured in this way.

In this realm we have particles moving through what we call Space Time which in Pi-Space is composed of these non-local Field Points. Particles such as electrons or light particles for example move through it. Results cannot easily be predicted when for example light and electrons move through these Field points. This gives rise to the Probability Pi-Shell to model the effect on Space Time from a Pi-Space perspective. What this means is that if we run a certain number of experiments a number of times we can predict the result in a location by a probability value. This is related to the size of the Field Point at that place.

As I've already shown, the particle follows the path of least time which is the location where the Field Points are the smallest and there is a probability for an event occurring here as a consequence.

Therefore we can model a Field Point by means of a probability. The percentage is proportional to the diameter shrinkage of the Field Point.





In a local wave environment we think in terms of distance, time and velocity for example. With Field Points we use Least Time and Probability. In a classical reality, a moving Pi-Shell will follow the path of Least Time as well such as with a Geodesic.

They are essentially the same thing. In the classic world, we use v/c and in the non-local space we use a probability which is a diameter percentage. The rule of addition of these Pi-Shells is the same in both cases.

Orbits in the classical world tend to be a little more straight-forward (see section on orbits). In the case of the non-local Field Point one must model the waves which alter the Field Points and add up all the points to form a least time path which is trickier but achievable. This is essentially probability amplitude addition.

Probabilities sum from 0 to the final value so in most cases we are dealing with oscillations of the Pi-Shells. Therefore over some distance d and time t the Probability Pi-Shell will lose area at a particular rate and end up at this maximum compression and then oscillate back. The block of glass experiment is an example of this. The light wave or electron particle for example generates the non-local wave fronts which alter the Field Point Pi-Shells generating dynamic paths of Least Time.

In terms of the Math the exponent wave formula by Schrodinger models the Probability Pi-Shell diameter change as changing wave amplitude.

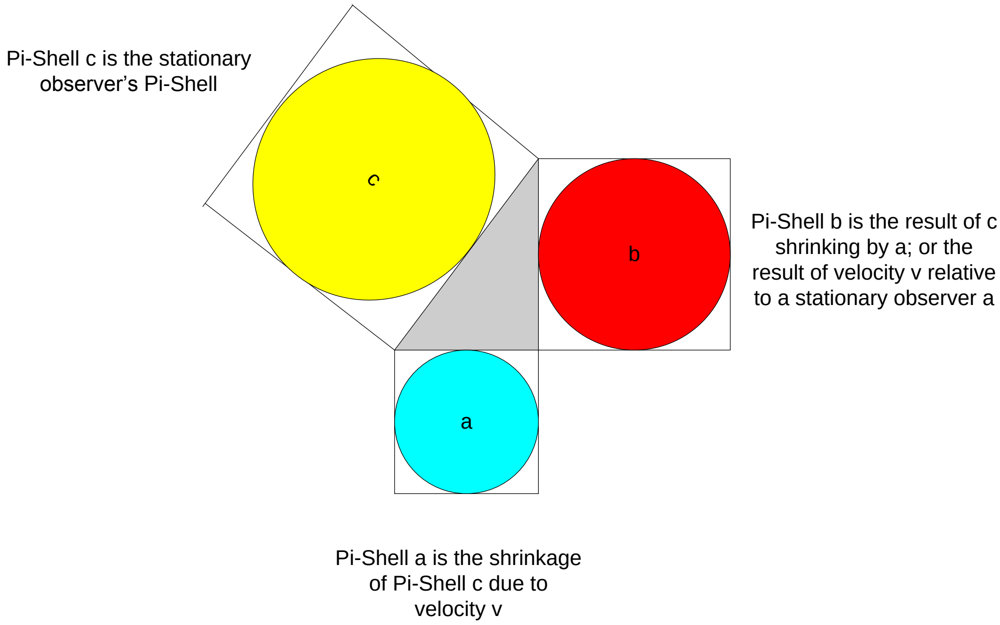
$$\psi(\vec{x},t) = e^{i(\vec{k}\cdot\vec{x}-\omega t)} = e^{i(\vec{p}\cdot\vec{x}-Et)/\hbar}$$

We square to get the area change of the field point probability which is the area change of the Probability Pi-Shell.

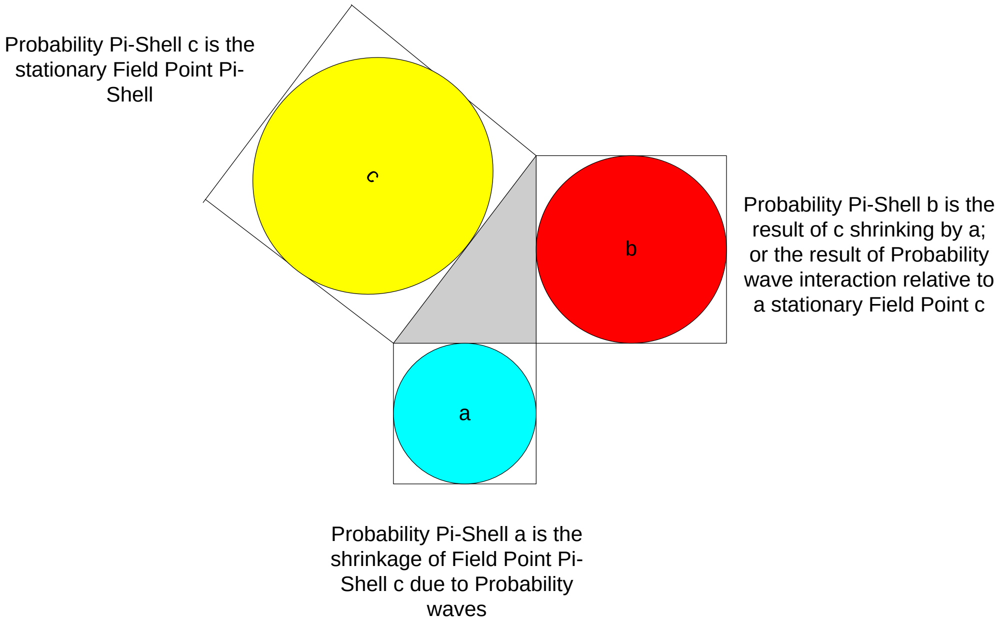
$$P(\vec{x}, t) = |\psi(\vec{x}, t)|^2$$

$$P_{\text{detector}} = |\psi_1 + \psi_2|^2$$

In Pi-Space the area loss of a Pi-Shell is translated in its simplest form into a diameter line which represents the diameter loss of the area. For a Classic Pi-Shell this is translated into a Newtonian velocity fraction of the speed of light. For a probability Pi-Shell this is a percent p/100. In both cases we deal with area loss, so if we want to add more than one probability with another, or add one arrow to another then we use Classic Pi-Shell addition. This is achieved using the Pythagorean Theorem.



If we add Pi-Shell a to Pi-Shell b we get Pi-Shell c. We can generalize this to Probability Pi-Shells. The diameter lines are the QED arrow amplitudes. Feynman discovered this principle in QED and showed that this was how the arrows could be added.



Therefore all we need to do is square the diameter lengths.

$$\pi c^2 - \pi a^2 = \pi b$$

This leads to the Pythagorean Theorem

$$\pi c^2 = \pi a^2 + \pi b^2$$

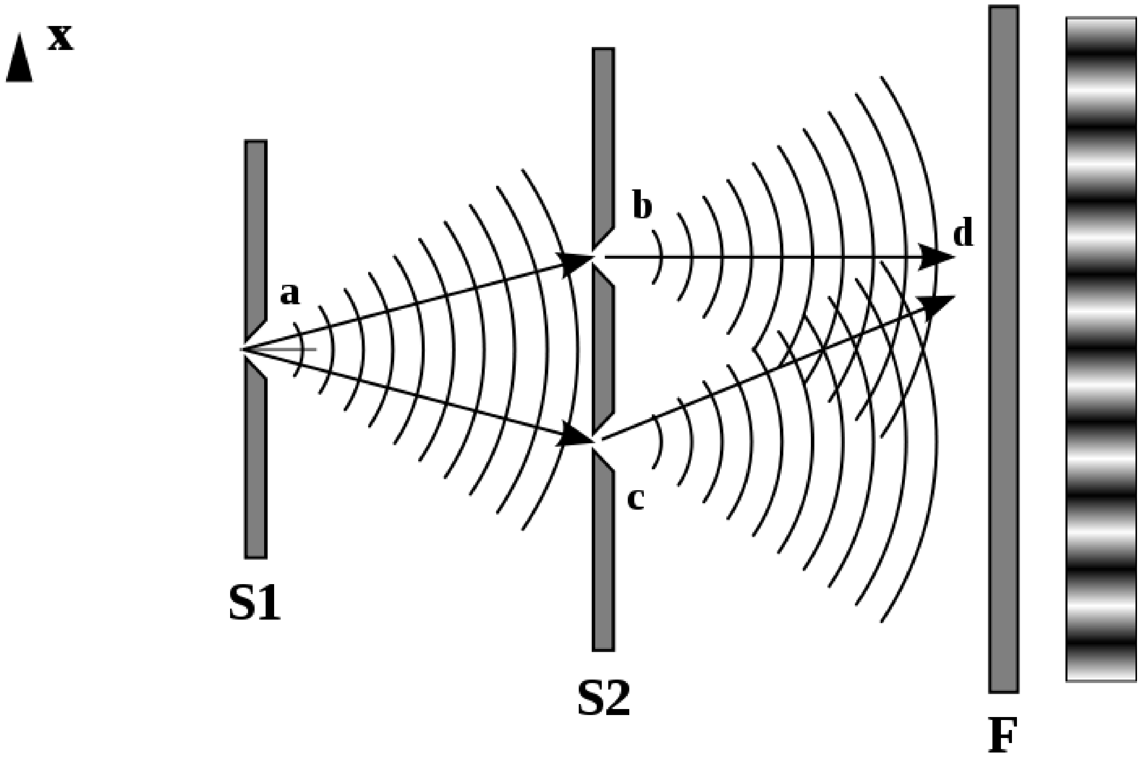
$$c^2 = a^2 + b^2$$

This is analogous to adding arrow a to arrow b head to tail using QED speak.

For the case where the angle is not ninety degrees we can use the Law of the Cosines. For the case where we want to know a resulting angle, we use the Law of the Sines. See the section on orbits.

A probability Pi-Shell is an area loss from 0 to the probability. Therefore there is a rate of change of probability amplitude with respect to distance and time. This is modeled on Trig functions which is part of the Advanced Formulas section. In theory, the probability Pi-Shell can also use these principles.

The wave ripples generating the amplitude / diameter change spread out as wave fronts. It is these waves which cause the Field Points to oscillate.



1.19 The Cosmological Constant in Pi-Space

Measurements of the expansion of the Universe have shown that the Universe is expanding at an accelerated rate. In GR, we have the Cosmological Constant.

$$R_{\mu\nu} - \frac{1}{2}g_{\mu\nu}\,R + g_{\mu\nu}\Lambda = \frac{8\pi G}{c^4}T_{\mu\nu}\ .$$

The Symbol is Λ. How can this be represented in Pi-Space? To model this, it is seen as an extension to the Wave Within Wave model. So far using the model we have drilled into the waves smaller than the Planck length. In this case, we model the waves which are termed Super Local. They are the waves on which the Nx(0) waves reside. We model them generically as Nx(-1 --). They are called Super Massive Local waves because their size covers distances we term Galactic. Therefore, these are the waves which are the parent waves of the local Nx(0) waves.

Let's take a look at the Gravity field and how it was defined earlier.

Field FDg(y)	*Name*	*Size (Decreasing)*	*Related Wave*
FDg(0)	Gravity Field	>= Planck Length	Ng(0)
FDg(1)	Mass Field	<Planck Length	Ng(1)

Next we extend this to include the Super Massive Local Waves

Field FDg(y)	*Name*	*Size (Decreasing)*	*Related Wave*
FDg(-1)	Expanding Space Time	> Galaxies	Ng(-1)
FDg(0)	Gravity Field	>= Planck Length	Ng(0)
FDg(1)	Mass Field	<Planck Length	Ng(1)

The way we model the acceleration of the expansion of the Universe is by considering that FDg(-1) has a wavelength which is increasing with respect to area gain. Therefore this would model a Galactic acceleration as the Super Massive wavelength which increases over time t. As FDg(-1) grows larger, FDg(0) is stretched apart as they "live on" FDg(-1 --) so to speak. Therefore to the observer making measurements of the Universe, it will appear that the Galaxies are moving further apart increasingly over time t.

In theory, there is no limit to wave sizes in either direction of the +1 inner (smaller)/-1 outer (larger) waves.

1.20 Field Points versus Probability Pi-Shells in Pi-Space

So far in GR, we have Field Points and in QM we have Probability Pi-Shells.

These are two representations of the same things.

The Probability Pi-Shell, like the Field points form the fabric of Space Time. Therefore they are both smaller than the Planck Length.

In GR we model them getting smaller as one moves toward the center of gravity.

In GR in terms of measurement, we represent the Field Points altering the size of the Classic Pi-Shell which is typically modeled as an atom.

The Metric is the area change to the size of an atom represented in terms of an area change relative to an observer outside the Gravity field.

Proper Time is the diameter change relative to an observer.

So GR mainly focuses on how relatively large “local” Pi-Shells move through the Field Points which form Space Time.

Next we deal with Probability Pi-Shells which deals with how the Field Points themselves change size. **This is different from GR where we measure the changes to the Classic Pi-Shells moving through Field Point Space Time.**

Here we need to work out the changes to the sizes of the Field Points themselves.

As I’ve shown already, we cannot measure them using current technology so we use a predictive mechanism using probabilities. As I’ve already shown, the higher the probability, the smaller the Field Point can become.

Just like in GR, any quantum particle moving through this Field Point Space Time, will follow the path of Least time which means it moves towards the Field Points which are the smallest.

The field points also oscillate which means that they change size due to their interaction with wave functions which are modeled in QM.

Note that in GR, one does not need to model the size change of the field points, all one must do is model the change to the area of the moving Pi-Shell or the change to its area as it moves within this field. This therefore maps to the Potential. This is outlined in the Classic Gravity sections. Also, like QM, the Geodesic is the Path of Least Time for a Classic Pi-Shell so the two approaches are the same.